PROCEEDINGS

OF THE

CORPORATION OF NEW-YORK,

ON

SUPPLYING THE CITY WITH

Pure and Wholesome Water:

WITH

A MEMOIR

OF

JOSEPH BROWNE, M. D.

ON THE SAME SUBJECT.

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M,DCC,XCIX.

BRITISH MUSEUM

Dedicatory.

TO the CORPORATION of the City of *New-York*, the following *Memoir* of the utility and means of furniſhing the City with Water from the river Bronx, is reſpectfully addreſſed by their very humble ſervant,

JOSEPH BROWNE.

West-Chester,
July 2d, 1798.

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City of New-York, } ſs. AT a COMMON COUNCIL, held on Monday the 17th day of December 1798,

The following REPORT *was read and agreed to by the Board, viz.*

The Committee appointed to inveſtigate the ſubject of ſupplying the City of New-York with water,

REPORT,

THAT being impreſſed with the importance of the ſubject, they have conſidered it with all the care and attention in their power, and incline to the opinion that the BRONX RIVER *will afford a copious ſupply of pure and wholeſome Water :—They incline alſo to think, that the plan ſuggeſted by Dr.* JOSEPH BROWNE, *for conveying the water of that river is, with ſome few variations, the moſt eligible that can be adopted. But as any miſtakes in the plan or conduct of the buſineſs, may be attended with incalculable miſchief, they would recommend, that* Mr. Weſton, *who has been the Engineer for the Canal Companies in this ſtate, and whoſe abilities are well known, be requeſted to examine that river, with the ſituation of the grounds to* *be employed in the Aqueduct, and ſuch other matters incident to the ſupply of the City with pure and wholeſome water, from that or any other ſource, as he may think proper; and that he be requeſted to report his opinion to the Corporation, with the requiſite plans and eſtimates, as ſoon as may be practicable.*

YOUR Committee further report, that they have conſidered the ſeveral modes which have been ſuggeſted for the execution, either by individuals or by the Corporation, of the plan that may be finally adopted. They are ſenſible that each of theſe methods is attended with difficulties;—but conſidering the immenſe importance of the ſubject to the comfort and health of their fellow citizens, *that it will not be undertaken by a company, unleſs upon the proſpect of conſiderable gain, and that ſuch gain muſt be acquired at the expence of the city, your Committee have at length agreed, that the undertaking ought to be purſued by, and under the controul of the Corporation, as the immediate Repreſentatives of the Citizens in general.*

UNDER this impreſſion, and to avoid any further delays, which may ariſe, unleſs meaſures are taken to prevent pecuniary embarraſſments and other difficulties in the courſe of the buſineſs, your Committee would recommend,

THAT an Act be prepared and preſented to the Legiſlature inveſting the Corporation with the powers neceſſary to effect the great end they have in view, and granting them the monies ariſing from the Tax upon Sales at Auction in the ſaid City, with ſuch further aid as the Legiſ-

lature may think proper to enable them, by the reception thereof, or by loans founded thereon, to defray the expences incident to the undertaking.

JOHN B. COLES.
GABRIEL FURMAN.
JOHN BOGERT.
JACOB DE LA MONTAGNIE.

NEW-YORK,
17th Dec. 1798.

Memoir, &c.

IN a little treatiſe I have lately publiſhed addreſſed to the Citizens of New-York, on the Yellow Fever, I have endeavoured to ſhew that the diſeaſe is of a local nature, ariſing principally from a ſource which is pretty much in our power to prevent or remove, by an unremitted attention to *cleanlineſs*, to which purpoſe it is obvious that a plentiful ſupply of water is eſſentially neceſſary. It may not be amiſs here to recapitulate conciſely the principles on which I have founded my theory.

ALL animals and vegetables are in a perpetual ſtate of decompoſition and renovation—the organic principles of thoſe two kingdoms are nearly the ſame, but differently modified, and which mutually depend on each other for their vitality; this reciprocity is effected through the medium of the atmoſphere, which, inſtead of being a ſimple element, is now well aſcertained to be a compound of two gaſes or airs, unequally combined as to quantity—the ſmaller quantity, which is only about twenty-eight per cent. of the whole, contributes principally tothe ſupport of animal life, by the intervention of lungs or ſomething correſponding thereto, and may therefore be called animal vital air. The reſidue of ſeventy-two per cent. contributes to the ſupport of vegetables through the agency of their leaves, and may, therefore, with propriety, be called vegetable vital air. It is to be remarked that both of thoſe kingdoms, when in a ſtate of putrefaction or decompoſition, furniſh the latter ſpecies of air only, in which animals cannot exiſt, but in which vegetables thrive well. The putrefactive ſtate of vegetables takes place only after the death of the plant—but animals have a conſtant tendency to this ſtate during life, which is more or leſs ſtrong, according to the temperature of the atmoſphere, and which tendency is counteracted by the gas, that is received by breathing into the lungs and ſeparated by them from the atmoſpheric air, which is known to be the baſis of acidity, and has for this reaſon been called by the French Academicians—OXIGEN. Whenever, therefore, a greater exceſs than ſeventy-two per cent. of vegetable vital air prevails in the atmoſphere, the animal vital air muſt decreaſe in the ſame proportion, conſequently the proneneſs that animals have to a putrefactive ſtate, not being ſufficiently overcome by this acid principle, diſeaſes of a more or leſs putrid nature muſt be the reſult, in proportion as the deficiency is more or leſs great or the tendency more or leſs ſtrong.

IF this theory be juſt, it is of the utmoſt importance to remove from the houſes, ſtreets, and docks, every ſpecies of animal and vegetable matter, when in a putrefactive ſtate, to which purpoſe nothing ſo effectually contributes, as a plentiful ſupply of water.

WATER is not only of infinite importance to the health of the city, conſidered in a mechanical point of view, but from its known conſtituent parts, it may alſo be made to contribute to the ſame end chymically;—being a compound of 85 parts of animal vital air and 15 of hydrogene or inflammable air. Water, therefore, appears to be natures great magazine, in which is locked up an incalculable quantity of this moſt indiſpenſible requiſite to animal exiſtence, which is let looſe in its ærial ſtate, by abſtracting from it the hydrogene with which it is combined. This proceſs is conſtantly performing by vegetables, when in a ſtate of verdure, whoſe leaves when moiſtened with dew or ſprinkled with water, having a greater affinity or attraction for the hydrogene, than hydrogene has for animal vital air, a de-compoſition of the water takes place—the hydrogene becomes fixed in the plant, and the animal vital air being thus diſengaged, is poured into the atmoſphere to be from thence again abſorbed by animals, without which their exiſtence ceaſes.

THIS fact ſuggeſts the propriety and utility of encouraging the planting of trees in all ſuch ſtreets, as are not too confined, which trees ſhould be frequently, in warm weather, ſprinkled with water.

ON Philoſophical principles alſo, the air of a city may be rendered more ſalubrious, by frequently ſprinkling the ſtreets with water in dry, hot weather, by which means a rapid evaporation takes place. In the Eaſt and Weſt Indies, the cooling of liquors by ſurrounding the bottles with wet cloths and expoſing them to a current of air, is a practice well known; the following Theory accounts for the fact:—

THE heat or caloric, with which all bodies are combined, has a conſtant tendency to equaliſe itſelf with all ſurrounding bodies, a proceſs which is longer or ſhorter in its operation, in proportion as thoſe adjoining bodies have a leſs or greater affinity for caloric.—The ſame body with different quantities of caloric may be either ſolid, liquid or æriform; for inſtance, water with leſs caloric becomes ice, with more, it becomes vapour. Water is one of thoſe ſubſtances that has a peculiar aptitude to combine itſelf with a ſurpluſs of caloric, which then aſſumes the ſtate of vapour and flies off, leaving the body with which it was previouſly combined, cooler, in proportion as this new combination has taken place. The ſun itſelf is probably not hot, it may have only the faculty of excitement, that is, of evolving caloric from a latent to a perceptible ſtate, and this excitement is generally in proportion to the denſity and colour of the body on which it acts—its effects are therefore ſcarcely, if at all, perceptible in its paſſage through the atmoſphere, which can only be heated by coming in contact with ſome more ſolid body that has felt its influence.

Since New York has been paved, the bricks in the ſtreets in hot ſummer days, are frequently heated to 150 degrees of Fahrenheit's Thermometer; the ſurrounding atmoſpheric air muſt therefore ſlowly partake of this heat, and conſequently become more rare, which is, I conceive, one of the cauſes of its inſalubrity, for the ſame volume of atmoſpheric air will not contain half as much animal vital air when the Thermometer is at 90 as it does when at 32—that is, a cubical foot of atmoſpheric air does not weigh half as much in ſummer as in winter, which is probably the reaſon why froſty weather is ſo ſure an antidote to the Yellow Fever—whatever then will, in any degree, tend to cool the air of the city, will, in the ſame proportion, render it more healthful.

I do not preſume to ſay, that the introduction of a large quantity of water into the city, would alone prevent the riſe and ſpreading of putrid diſeaſes, but I am well warranted in ſaying, that, under providence, it would, more than all other things, contribute to this moſt deſirable end.

Next to Peſtilence—Fire may be reckoned the greateſt Calamity, to which Cities are ſubject. I need not take up any of your time in mentioning the immenſe advantages, of always having at hand a plentiful ſupply of water on ſuch a melancholy occaſion. Thoſe two motives are alone, one would ſuppoſe, ſufficient inducements, to procure at almoſt any price, a permanent and plentiful ſupply of water, as the principal means of preventing or at leaſt diminſhing ſuch cataſtrophes—but excluſive of thoſe advantages, there is another though of a ſecondary nature, yet as a ſource of comfort and pleaſure, is well deſerving attention.

THERE is nothing in warm climates that blends the uſeful and agreeable ſo much as public fountains and private baths. In ancient Rome, they were deemed not only luxuries, but became almoſt neceſſaries, for every garden had its fountain and almoſt every houſe its bath. The art of conducting waters from different ſources to their cities, (but principallyRome) and the diſtribution made of them among the citizens, was eſteemed by the Princes and Chief Magiſtrates of ſufficient importance, to deſerve every attention.—Rome was furniſhed with water from ten principal aqueducts, at the rate of nearly three hundred millions of gallons daily: it was conveyed to large covered reſervois, from whence it was diſtributed by ſubterraneous tubes, to fountains in different parts of the city, and from thence it was conveyed to their houſes and gardens. Theſe fountains were one of the principal ornaments of the city, being accompanied with ſtatues of Marble and Bronze.

ALL theſe works were maintained with the greateſt order and diſcipline, which requiring great authority, the Conſuls, and even the Emperors themſelves, made it a part of their immediate duty—regarding the ſupplying of the city with water as a thing of the firſt importance. The Conſuls had for a long time, the ſuperintendance of the Aquedects, but afterwards this part of their duty was conſigned to the Ediles, until the time of Auguſtus, who, to recompenſe Marcus Agrippa for the extraordinary pains he had been at during his Edileſhip, who had cauſed to be made 700 reſervoirs, 130 chateaux d'eau, and 150 pumps, magnificently decorated, created him ſuperintendant of the water works, and preſident of a company of 240 officers or commiſſioners. There was afterwards another company eſtabliſhed, conſiſting of 460 perſons—both of which companies were divided into different departments, whoſe excluſive employment was the conducting and diſtributing water through the city. The expence of thoſe Water Works, as may well be imagined, was immenſe—it amounted to upwards of one million two hundred thouſand dollars annually, including the ſalaries of the officers, and the repairs of the Aqueducts, Baſons, Fountains, &c.—each citizen paid in proportion to the quantity of water he was ſupplied with ; and even this ſum was ſome years inadequate to the purpoſe ; an extraordinary tax, therefore, ſometimes became neceſſary.

The principal cities of modern Europe, to be furniſhed with water, are obliged to have it brought to them at conſiderable expence, particularly London and Paris :—the former of thoſe cities, excluſive of the immenſe quantity that is daily forced from the Thames, by means of large water-wheels, that are turned by its current, and alſo by Steam Engines, is largely indebted to the Patriotic and great exertions of a ſingle individual, a Mr. Hugh Middleton, Citizen and Gold-Smith, of the city of London—who, in the year 1614, having obtained an Act of Parliament, for the purpoſe, brought in an Open Canal to London, the water from Am-Well and Shad-Well, in Hertfordſhire, a diſtance more than 20 miles. It is conveyed to a large reſervoir, near Iſlington, from whence it is diſtributed in Elm-Pipes, to moſt parts of the city. This water is now called the New-River, and is ſaid to run under near 800 bridges.

Paris is alſo ſupplied with water from the Seine, in a ſimilar manner as London is from the Thames—but thoſe parts of the city that are diſtant from the Seine, are ſupplied with water from ſprings in the neighbouring eminences of Belleville, pres St. Gervais, and Rungis, which is conducted to the city in ſubterraneous tubes, to different reſervoirs and fountains, accompanied with all the works neceſſary to its goodneſs and proper diſtribution.

But the moſt celebrated water works now in the world, are thoſe that furniſh the National Palaces and Gardens of Marly and Verſailles with water—they were conſtructed for Louis XIV. by a Mr. Rannequin, of Leige, and are a Monument of the magnificence and extravagance of that King—The water is taken from the river Seine, and forced 500 French feet above the level of that river to a large reſervoir, by means of three ſets of pumps—the firſt ſet carries it up 150 feet; the other two carrying it up 175 feet each: the whole number of pumps employed are 253—The quantity of water formerly raiſed in a day was 1,500,000 gallons; but at preſent, owing either to decay or neglect in the management of the machine, it does not now raiſe half this quantity. This famous aqueduct is ſaid to have coſt five hundred thouſand pounds ſterling.

Were the preceding purpoſes the only ones for which the city of New-York wanted a ſupply of water, it might eaſily be procured in any quantity, by means of Steam Engines, from the rivers, that waſh the ſhores of the city. But there is another and of more importance in the opinion of the Majority of the citizens of New-York, than all thoſe that have been already mentioned; and for which purpoſe, the river water adjoining the city, cannot be uſed—(to wit), for the conſtant daily conſumption of families, for drinking, waſhing, cooking, &c. for thoſe occaſions we muſt look to ſome other ſource.

The large ſtagnating filthy pond, commonly called the Collect, which now is or ſoon will be the center of the city, has been looked to by ſome people, as a fund, from whence an adequate ſupply might be obtained by means of a Steam Engine*, for all the purpoſes already ſpoken of. I cannot undertake to ſay, that this ſource wo'd at preſent be incompetent to all the preceding purpoſes, for which a ſupply of water is wanted; but if the quantity naturally diſcharged from this pond, be the whole that is furniſhed by its ſprings, then I might ſay, with propriety, it is infinitely too ſmall for thoſe uſes. But admitting that at preſent, it might be competent, the time will come, and that very ſhortly, from the growth of the city, when this ſource will moſt certainly be very inadequate to the demand. And again, ſuppoſing the pond to contain and furniſh enough, it is a conſideration well deſerving attention, whether a pond into which the filth, from many of the ſtreers muſt without very great expence and care, be conſtantly diſcharged, and to which the contents of vaults &c. will continually drain, is a deſirable ſource from whence we ſhould like to take water for drinking, cooking, &c. without taking into the account its noxious qualities, medically conſidered—although it may be laid down as a general rule that the health of a city depends more on its water, than on all the reſt of the eatables and drinkables together.

WITH reſpect to other ſources from ſmall ſprings, ponds, &c. on the Iſland of New-York, ſome of the ſame objections may be made to them all. The city muſt then look to ſome other place for a permanent and plentiful ſupply of good water.

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* The expence of a ſteam engine, of a cylinder, ſufficiently large to force up 300,000 gallons of water per day, a height of 40 feet, with the houſe, apparatus, and pipes of conduit to a principal reſervoir, including the coſt of ſuch reſervoir, would amount to 50,000 dollars; ſuch a ſteam engine would conſume, daily, a chaldron of coals, or two cords of wood, which may be deemed equal to another capital of 50,000 dollars; ſo that the firſt coſt of the machine, &c. and its continual charges, may be deemed equal to a capital of 100,000 dollars, excluſive of riſk, repairs, &c.

The ſtream in the County of Weſt-Cheſter, known by the name of Saw Mill river, which empties into the North river, beyond the nineteen mile ſtone, has been mentioned by ſome as excellent water, and capable of affording all that is wanted. I have no objection to make to the truth of this aſſertion—but the expence of bringing this water nineteen miles, over ſo rough a country, would be greater than could be probably raiſed for this purpoſe, even admitting the neceſſary ſupply could not be had otherwiſe—but fortunately New-York is not in this dilemma, for there is another ſource equally copious and full as pure, that may with great facility be obtained for a quarter part of the expence (to wit.)

THE RIVER BRONX,

Whose principal ſource is from a ſmall lake, about four miles to the Northward of the White Plains. This Lake is nearly three miles in length and half a mile wide. After meanding twenty miles through a rocky part of the County of Weſt Cheſter, it falls into the Eaſt River, juſt above Hunt's Point. The neareſt point of its approach to the City of New York, is at preſent about 12 miles from the City Hall.

This water is remarkably pure and pellucid, and from a chymical analyſis which has been made of it, it may be relied on as poſſeſſing no noxious qualities. The inhabitants who live near its banks, are in the conſtant habit of uſing it in preference to other water during cold weather, and experience no bad effects from it. It may not be amiſs to mention a few teſts that are the only ones neceſſary to aſcertain what is good water—the firſt is to boil leguminous vegetables in it, the ſecond to mix it with ſoap, for water that contains any of the ſalts with an earthly baſe, ſuch as nitrate of lime and magneſia, muriate of lime and magneſia, ſulphat of lime, or carbonate of lime and magneſia, will not do well for either of the above purpoſes, for having a great affinity to the mucilage of plants, it extracts it, and thereby renders them hard and diſagreeable to the taſte. Soap is likewiſe an excellent teſt, which is known to be a chymical compound of alkali and oil or fat. All ſalts with an earthly baſe, decompound ſoap by a double exchange; their earth unites itſelf with the oil or fat, whilſt their acid combines with the alkali of the ſoap, and by the combination of the oil and earth, is formed a ſoap which is inſoluble in water, and makes thoſe clots or curdles, which we perceive in mixing ſoap with what is generally called hard or crude water. Water then that is clear and from a running ſource that boils leguminous vegetables tender, in which ſoap readily diſſolves, and has no bad flavour, may be pronounced good water—to all theſe teſts, the water of the Bronx has been ſubmitted, and from whence we cannot but pronounce it excellent. I ſhall now endeavor to point out an eaſy method of carrying it to New-York. It has already been mentioned that its neareſt approach to the City-Hall, is about 12 miles diſtance; but at about 14 miles diſtance, which is half a mile below Williams's bridge, is a piece of low meadow ground, in which ariſe two Springs—one of which runs eaſterly, and empties itſelf into the Bronx, at not more than 400 yards from its origin. The other Spring runs ſoutherly and empties into Haerlem River, after traverſing a diſtance of about ſix miles. The place where thoſe Springs originate, is not more than five feet above the level of the Bronx, and ſometimes part of the river, when raiſed by a conſiderable freſhet, has run over part of this meadow and emptied itſelf into Haerlem river. From thoſe reaſons, then it is obvious that by building a Dam, five feet in height, acroſs the Bronx, below where the firſt mentioned Spring empties itſelf into it, and by digging a Canal 400 yards in length through the meadow, the whole of the Bronx, if neceſſary, might be diverted from its old rout, and thrown into Haerlem river, at about 8 miles diſtant from the City-Hall. The place where the Bronx, may be thus diverted, is about 50 feet above high water mark.

When I firſt intereſted myſelf on this ſubject, I was in hopes a place ſufficiently high might have been found, from whence the water of the Bronx could have been conducted to New-York, in pipes of conduit, without any previous Machinery; but I am now ſatisfied, no ſuch place exiſts; for although water in an open aqueduct, will run with tolerable fluency, having only ſix inches fall in a mile, yet in a pipe of conduit it requires a five feet fall, to produce the ſame effect; and even this fall is inſufficient where the pipe of conduit is of conſiderarle length, and of ſmall diameter; for the friction that is occaſioned by the ſides of the pipe of conduit, is in a quadruple-ratio with its length. Now, as the ground in the city of New-York, to which water ought to be conveyed to a principal reſervoir, is about 40 feet above high water, which is ten feet only below the level of the River, from where the Bronx may be diverted, I conſider it as a fall perfectly inadequate to any deſign of conveying the water in a pipe of conduit only. It becomes neceſſary then, that the water of the Bronx muſt firſt be elevated, by means of ſome Machinery, which I ſhall now endeavor to point out.

A simple mode of bringing the Bronx to within 8 miles of the City-Hall, as we have ſeen, is within our reach; let us ſuppoſe it now at Morriſania, and emptying itſelf into Haerlem River, out of the little creek that divides the land of Colonel Lewis Morris, from that of Mr. Gouverneur Morris; it will then be about 40 feet below the height of the Park, in front of the Goal, &c.—it will therefore become neceſſary to elevate it at leaſt as high as this ſpot; probably it might be ſtill better to give it a greater elevation, (for inſtance) as high as the Corporation Land in the vicinity of the Dove, about five miles from town, which is about 40 feet above the Park, or 80 feet from high water mark.

The firſt thing to be determined, is the quantity of water that would be deemed ſufficient for all the purpoſes already mentioned. The ſupply ought to be a liberal one—it appears to me it ought to be at leaſt 300,000 gallons, per 24 hours; one third of which will be competent for all potable and culinary purpoſes, waſhing, &c.—there will then remain 200,000 gallons, to be daily made uſe of, for waſhing ſtreets, &c. The principal reſervoir ſhould contain at leaſt the whole of this quantity, as a reſource in caſe of fire, which with its permanent ſupply, is more than ten of the largeſt fire engines could exhauſt in 6 hours. Admitting then that 300,000 gallons are ſufficient for the daily allowance, the next thing to be conſidered is the power to be applied to force this quantity of water a perpendicular height of 80 feet; for it is to be obſerved that its perpendicular height is only to be regarded in the calculation, and not its horizontal diſtance—except that diſtance be a great one: for this reaſon it is probably better to force water a perpendicular height of 80 feet at the horizontal diſtance of 3 miles, than to force it 40 feet high at the diſtance of 8 miles. I do not ſay that in all caſes this is correctly true. If water running in pipes of conduit, had no other obſtacles to ſurmount, than thoſe occaſioned by the friction of the ſides of the tubes, rules ſufficiently correct for practice, might be deduced; but it is almoſt always the caſe, that in pipes of conduit of conſiderable length, part of the courſe is zig-zag, and part of it over aſcending and deſcending ground; from both of which cauſes the velocity of water is greatly retarded. It is, therefore, extremely difficult to apply with correctneſs any theory to practice. It is always moſt prudent therefore to make ample allowances in all our calculations.

The power I propoſe to apply for this purpoſe, is the Bronx itſelf. If the whole of the river be diverted in the way I have mentioned, in the dryeſt ſeaſons it may be calculated that the water iſſuing from it, is equal to 1200 cubic feet per minute, which at 62 1-2 lb. the weight of a cubic foot of water, is equal to 135,000 hogſheads of 100 gallons each per 24 hours. Near where this water would enter Haerlem river, is an excellent ſituation for a mill ſeat; ſuppoſe a dam then to be erected of 6 feet in height at this place, it would furniſh a power to be calculated as follows :

From acknowledged and experimented principles of hydroſtaticks, the velocity of water is as the ſquare root of its perpendicular height; that is, the velocity of water ſpouting under a four feet head, is 16 feet per ſecond nearly, (I purpoſely avoid fractions) conſequently the velocity of ſpouting water from under a ſix feet head, will be nearly 20 feet per ſecond, and if the aperture of a penſtock be 12 inches ſquare, the quantity of water diſcharged per ſecond will be 20 cubic feet, which is the quantity that the Bronx will continually furniſh in the dryeſt ſeaſons; this then creates a power of 1250 pounds per ſecond, which is the weight of 20 cubical feet of water. The velocity of a water-wheel when loaded with its maximum is 1-3 of the velocity of the water ſpouting on it. Admitting then we have a water wheel of 20 feet diameter which will be 60 feet circumference, it will make ſeven revolutions in a minute, under a head of 6 feet water with a penſtock of 3 inches high and 36 inches long, which muſt be the length of the float boards of the water wheel. On the water wheel ſhaft muſt be a cog wheel to drive one or more wallowers to move the piſtons of the forcing pumps; the cog wheel ſhould be 6 feet diameter, having 54 cogs in it ;

the wallower one foot diameter, with 9 rounds in it; the wallower then makes 6 revolutions to every revolution of the water wheel, conſequently the piſtons of the pumps will make 42 ſtrokes in a minute. Admitting the pipes of conduit, leading from the pumps to the reſervoir at the Dove, to be 6 inches diameter, and 50 feet perpendicular height, when full of water its weight will be equal to 15 ſquare feet, or 937 lb.—this weight is to be overcome at each ſtroke of the piſton, by the weight of water, as I have already mentioned, that is perpetually operating on the water wheel, which is equal to 1250 pounds: the arms of the water wheel act as levers whoſe impulſe is aſcertained by multiplying their length by the weight of water preſſing on them—1250 pounds then multiplyed by 10, the length of the arm from the center of the ſhaft, is equal to 12,500 pounds, which muſt be divided by the length of the arm of the cog wheel, which being three feet, leaves 4166 pounds as the actual power of the water wheel, 5-9 of which is loſt in overcoming friction, &c.—of courſe four-ninths can be calculated on only, to produce its greateſt product or maximum effect, which leaves 1851lbs. as the efficient power of the water wheel, which is equal to the power requiſite to work four forcing pumps, two of which will be in ſtate of inaction, whilſt the other two are forcing. As the water wheel makes ſeven revolutions in a minute, and the wallower ſix times as many, each pump makes 42 ſtrokes in a minute, the four pumps will then make together 168 in a minute. If the crank of the wallower be 9 inches deep, it will give 18 play to the piſton, and if the piſton works in a ſix inch bore, it will deliver at each ſtroke 436 cubical inches of water, equal to 15 ℔. which for the four pumps is equal to 315 gallons per minute, or 463,600 gallons per day. As the piſtons and valves of them are never perfectly tight, it is uſual to allow 1-5 waſtage for this purpoſe, which leaves 362,880 gallons to be delivered daily into the reſervoir at the dove.

I HAVE thus ſhewn that the Bronx itſelf may be made uſe of, as the only agent requiſite to deliver at a reſervoir near the Dove, all the water neceſſary for the daily conſumption of New-York. From the reſervoir at the Dove, a pipe of conduit of ſix inches diameter, will be requiſite to deliver the water to a principal reſervoir in, or near the City.

I SHALL next endeavour to calculate the expence.—Below the place mentioned as a proper ſituation for diverting the Bronx, are four mills—one employed as a ſnuff-mill—the next intended as a mill for ſpinning of cotton, &c.—the next a griſt-mill—the laſt uſed for a bleach-mill and callico-printing. For ſix months in the year thoſe mills will not be much injured by deverting part of the ſtream—for three months they may probably be uſed one half of their time—but for three months they may be reckoned as totally idle, that is, July, Auguſt and September.

	Dollars.
The damages to thoſe mills, which muſt be paid for, may be ſtated at	20,000
To building a dam acroſs the Bronx—purchaſing the land adjoining, and paying damages for overflowing lands above the dam	2,000
To digging a Canal through a meadow 400 yards in length at the Bronx, and widening the preſent rivulet, with damages done to the lands, from the Bronx to Haerlem river	5,000
To building a dam acroſs the rivulet at Moriſania—purchaſing lands for the works to ſtand on, and for overflowing land above the dam	4,000

To water-wheel, ſix pumps*, mill-houſe, and Overſeer's houſe	6,000
To 44,000 feet of pipes of ſix inches diameter, and laying the ſame three feet under ground, at 4s. per foot	22,000
To extra expences in croſſing under Haerlem bridge, and ſecuring pipe from froſt	2,000
To damages to land in laying the pipes	1,000
To two covered reſervoirs, each to contain 300,000 gallons of water	10,000
To ſuperintending, and a number of ſmall charges not enumerated, ſuch as air-pipes, regards, croſſing gullies, &c.	28,000
	100,000
The ſtreets in the city thro' which the pipes will be carried, will probably be about 20 miles in length, the expence for piping the ſame, with fire plugs, air pipes, one or two public fountains, &c. may be eſtimated	100,000

I HAVE thus eſtimated the whole expence to be 200,000 dollars. In making my calculations, I believe this ſum will be the outſide coſt, and conſidering the magnitude of the object, and the wealth of the city of New-York, the ſum is very trifling.

THE Corporation in conſidering this ſubject, will no doubt take in view the rapid growth of the city, which muſt continue to encreaſe, in a certain ratio with that of the ſtate, and the neighbouring ſtates, where there is no competitor city for their commercial concerns. Admitting that 300,000 gallons of water, are at preſent only ſufficient for the preſent neceſſities of the city, in a few years this quantity will be too ſmall. The zeal of the Corporation, as fathers of the city, will induce them to regard the future, as well as the preſent welfare of the city. The river Bronx contains more than 40 times the quantity of water that is now wanted; and although the river is capable of forcing up more than is at preſent required, yet in a ſhort time it will not be able to do ſo—it may then be not amiſs to inquire what other mode may be adopted for this purpoſe. The river Bronx may at any time, for a ſmall additional expence, be diverted from the place which I have ſuggeſted as the beſt at preſent to carry it to, to the excellent bridge which has lately been built over Haerlem river, by John B. Coles, Eſq.—Under this bridge Mr. Coles is authoriſed by act of the Legiſlature, to erect a mill-dam acroſs Haerlem river, which, as a tide-mill will be one of the beſt in the world; it will be capable of carrying from ſixty to 80 ton of ſtones; a part or the whole of this power may, if neceſſary, be employed in forcing the Bronx to New York, inſtead of grinding grain. This conſideration will, no doubt, have ſome weight with the Corporation.

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* I have calculated for two additional pumps, in caſe of occaſional repairs.

I AM under no apprehenſion that the Corporation will ever ſeriouſly think of forcing the inhabitants to drink the diſguſting water of the Collect—but it is of conſiderable importance that the Corporation ſhould ſpeedily determine with reſpect to the Bronx—at preſent the value of the mills that will be effected by diverting the water, is not great, but the excellence of the water, the healthineſs of the country, the goodneſs of the roads from New-York, and its vicinity to that city, point it out as a moſt eligible ſituation for different manufactories; when expenſive eſtabliſhments of this kind take place, it will be very difficult for the city to command a river, which will one day or other be found to be of infinite importance to its intereſt. If the Corporation ſhould not at preſent determine to have its water brought to the city, no time ſhould be loſt in purchaſing the right of doing it at ſome future time—it may never hereafter be in their power to do it—at leaſt without a very great expence. As the funds of the Corporation are probably not adequate to an undertaking of this kind, I ſhall beg leave to ſubmit to their conſideration, a plan of an aſſociation for the purpoſe. The ſum requiſite, as already ſtated, is 200,000 dollars—as a great majority of the inhabitants have an intereſt in ſuch an undertaking, and muſt feel a wiſh to promote it, I ſhould propoſe that the ſtock ſhould be divided into 2000 ſhares of 100 dollars each—that three gentlemen ſhould be appointed to receive the ſubſcriptions, but in ſuch a way that no man ſhould be entitled to more than one ſhare, at leaſt not till after a given time, and that the whole number of ſhares ſhould not be ſubſcribed for by ſingle ſhares. There can be no difficulty in procuring from the Legiſlature, an Act of Incorporation for ſuch an Aſſociation, at the requeſt of the Corporation. The outlines of the plan may be as follows:—

The Corporation of the City of New-York, engage with A. B. and C. and their Aſſociates, to procure an Act of the Legiſlature at their next Seſſion, to incorporate as a body politic the ſaid A. B. and C. and their Aſſociates, by the name of the Aqueduct Company of the City of New-York—with the authorities and powers incident to ſuch an eſtabliſhment, on the conditions following:—The ſaid Company engage to ſupply the City of New-York daily, at the rate of 300,000 gallons of Water, from the river Bronx, to be delivered into ſuch Reſervoir or Reſervoirs as ſhall be furniſhed, at leaſt the ground thereof, by the ſaid Corporation ;—that the ſaid Water ſhall be conveyed through all the principal ſtreets of the City, in pipes of Conduit, in which pipes, at convenient diſtances, ſhall be conſtructed, Fire-Plugs, thro' which the whole of ſaid 300,000 gallons may at any time, in caſe of fire, be diſcharged into any particular ſtreet, for which purpoſe a Watch-man ſhall conſtantly attend at the principal Reſervoir ; the reſidue of Water not otherwiſe wanted, ſhall be daily made uſe of, under the direction of the Corporation, for waſhing ſuch ſtreets as they may direct.

THAT every houſeholder, in all the ſtreets in the ſaid city, through which the ſaid pipes of conduit ſhall be laid, ſhall be entitled to receive daily from the ſame, a ſupply of at leaſt 30 gallons of water through pipes, to be provided by himſelf or themſelves for that purpoſe, to communicate with the pipes of conduit.

THAT the ſaid company ſhall at their expence, cauſe to be conſtructed on the Battery or Bowling-green, as the Corporation ſhall direct, an ornamental fountain and *Jét d'Eau*, from whence a pipe of conduit ſhall be carried to ſome convenient wharf, from whence the ſhipping in the harbour may be ſupplied with ſuch quantities of water as their owners may require.

As a compenſation for all which the ſaid company ſhall be authorized to receive annually from every houſe in the ſaid city, which is, or ſhall be built on any ſtreet, through which the ſaid pipes of conduit ſhall paſs, a ſum not exceding an average of two dollars.

THAT the ſaid company ſhall alſo receive from every houſe from which a pipe ſhall communicate with the pipes of conduit, a ſum not exceeding an average of eight dollars per annum, both of which ſums ſhall be aſſeſſed, levied, and paid under the direction of the Corporation.

THAT the veſſels in the harbour ſhall not pay a greater ſum than   per hogſhead, for every hogſhead they may be ſupplied with.

PROVIDED always that the annual net-revenue of the ſaid company, ſhall not in any one year, exceed twenty per cent. of the monies that ſhall have actually been expended, in the conſtruction, repairs, and maintenance of the ſaid works—the ſurplus, if any, ſhall be appropriated for ſuch purpoſes as the Corporation ſhall direct.

THE preſent revenue of ſuch a company may be eſtimated as follows :

	Dollars.
To an annual tax of 2 dollars from 6000 houſes	12,000
To annual payments of 8 dollars from 3000 houſes	24,000
	36,000
Deduct for expences of management, repairs, &c.	10,000
	26,000

WHICH is equal to an intereſt of 13 per cent, on the original ſtock.

IN the above calculation, I have eſtimated that as every houſe is equally intereſted in whatever means can be made uſe of as a preſervation from fire and peſtilence, each ought to contribute towards it equally in proportion to its relative value—for ſuch purpoſes an average of two dollars per annum, from each, muſt ſurely be reckoned a trifling conſideration.

As many parts of the city are contiguous to tolerable good water from pumps. I have eſtimated one half of the houſes in the city only to be ſupplied from the aqueduct, although as it ſupercedes the neceſſity of having wells and rain water ciſterns in the yards, an average of eight dollars per annum, is probably leſs than the intereſt of the firſt coſt of wells and ciſterns, and their conſtant repairs, even though the tea water, as it is called, ſhould coſt nothing.

If any ideas in the preceding Memoir, ſhall add to the uſeful information the Corporation is already poſſeſſed of, I ſhall be happy to have been their ſubordinate agent in contributing to the health of the City, not by curing its Diſeaſes, but what is conſiderably more meritorious—BY PREVENTING THEM.

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ROBERT BENSON, Clerk.

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